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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/606,820	06/26/2003	Philbert F. Marsh	RTN2-152PUS	5464
22494	7590	02/17/2004	EXAMINER	
DALY, CROWLEY & MOFFORD, LLP SUITE 101 275 TURNPIKE STREET CANTON, MA 02021-2310			TRAN, TAN N	
			ART UNIT	PAPER NUMBER
			2826	

DATE MAILED: 02/17/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/606,820

Applicant(s)

MARSH ET AL.

Examiner

TAN N TRAN

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 26 June 2003.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-24 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-24 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 26 June 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All   b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 26 June 2003.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## **DETAILED ACTION**

### ***Drawings***

1. Figure 1-3 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

### **Specification**

2. Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and generally limited to a single paragraph on a separate sheet within the range of 50 to 150 words. It is important that the abstract not exceed 150 words in length since the space provided for the abstract on the computer tape used by the printer is limited. The form and legal phraseology often used in patent claims, such as "means" and "said," should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

The language should be clear and concise and should not repeat information given in the title. It should avoid using phrases which can be implied, such as, "The disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

### **Claim Objections**

3. Claims 1,21 are objected to because of the following informalities:

In claim 1, line 3, "indium aluminum arsenide (InAlGaAs)" should be changed to – indium aluminum arsenide (InAlAs)--.

In claim 21, line 3, "indium aluminum arsenide (InAlGa)" should be changed to – indium aluminum arsenide (InAlAs)--.

**Claim Rejections - 35 USC § 112**

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 11-15 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 11, lines 4-7, “such layer comprising InAlGaAs, such InGaAs having mole fractions of Al, In, and Ga of the lattice match layer gradually changing with height with a bottom portion having a lattice constant matching GaAs and a top having a lattice constant of the InAlAs barrier and InGaAs channel layers” **is unclear as to what does applicant mean by such layer comprising InAlGaAs, such InGaAs having mole fractions of Al, In, and Ga of the lattice match layer gradually changing with height with a bottom portion having a lattice constant matching GaAs and a top having a lattice constant of the InAlAs barrier and InGaAs channel layers?**

***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's prior art (APA) in view of Sawada (5,650,642).

With regard to claim 1,6,9,10,16,19-21, APA discloses a gallium arsenide (GaAs) semiconductor substrate; the lattice matching layers formed over GaAs substrate; an indium aluminum arsenide (InAlAs) barrier layer disposed over the lattice matching layers; an InGaAs channel layer disposed on the barrier layer; an InAlAs schottky layer on the InGaAs channel layer; and an InGaAs disposed over the InAlAs schottky layer. (Note fig. 1 of APA).

APA does not disclose an  $\text{In}_y\text{Ga}_{1-y}\text{As}$  lower channel layer disposed on the barrier layer, where  $y$  is the mole fraction of In content in the lower channel layer; an  $\text{In}_x\text{Ga}_{1-x}\text{As}$  upper channel layer disposed on the lower channel layer, where  $x$  is the mole fraction of In content in the upper channel layer and where  $x$  is different from  $y$ .

However, Sawada discloses an  $\text{In}_x\text{Ga}_{1-x}\text{As}$  lower channel layer 3, where  $x$  is the mole fraction of In content in the lower channel layer; an  $\text{In}_y\text{Ga}_{1-y}\text{As}$  upper channel layer 4 disposed on the lower channel layer 3, where  $y$  is the mole fraction of In content in the upper channel layer 4 and where  $x$  is different from  $y$ . (Note fig. 1 of Sawada).

Therefore, it would have been obvious to one of ordinary skill in the art to form the APA's device having an  $\text{In}_y\text{Ga}_{1-y}\text{As}$  lower channel, where  $y$  is the mole fraction of In content in the lower channel layer; an  $\text{In}_x\text{Ga}_{1-x}\text{As}$  upper channel layer disposed on the lower channel layer, where  $x$  is the mole fraction of In content in the upper channel layer and where  $x$  is different from  $y$  such as taught by Sawada in order to increase or maximize carrier concentration in the channel layer.

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With regard to claim 11, APA and Sawada disclose all the claimed subject matter as claim 1, except for a lattice matching comprising InAlGaAs, or InGaAs having mole fractions of Al, In, and Ga of the lattice match layer gradually changing with height with a bottom portion having a lattice constant matching GaAs and a top having a lattice constant of the InAlAs barrier. However, it would have been obvious to one of ordinary skill in the art to form the lower channel layer has a bandgap greater than the bandgap of the upper channel layer in order to achieve the lattice matching with respect to the substrate. Note (lines 20,21, column 1, figs. 1A-1C of Onda (6,448,119)) is cited to support for the well known position.

With regard to claims 2,7,12,17,22, APA and Sawada disclose all the claimed subject matter except for the lower channel layer has a bandgap greater than the bandgap of the upper channel layer. However, it would have been obvious to one of ordinary skill in the art to form the lower channel layer has a bandgap greater than the bandgap of the upper channel layer in order to increase the conductivity of channel layers.

With regard to claim 3,8,13,18,23, APA and Sawada disclose all the claimed subject matter except for the lower channel layer has a bulk electron mobility lower than the bulk electron mobility of the upper channel layer. However, it would have been obvious to one of ordinary skill in the art to form the lower channel layer has a bulk electron mobility lower than the bulk electron mobility of the upper channel layer in order to make an electron mobility as high as possible and to suppress the side gate effects in an integrated device.

With regard to claims 4,14,24, APA discloses  $x$  of  $\text{In}_x\text{Ga}_{1-x}\text{As}$  serves as  $y$  of  $\text{In}_y\text{Ga}_{1-y}\text{As}$  of applicant invention having a range between 0.53 and 0.6. (Note lines 25,26, page 4 of specification, fig. 1 of APA).

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APA does not disclose  $x$  is in the range between 0.15 and 0.90.

However, Sawada discloses the  $\text{In}_x\text{Ga}_{1-x}\text{As}$  upper channel layer 104 having  $x$  is in the range between 0.2 and 0. (Note lines 50-53, column 1, fig. 5 of Sawada).

Therefore, it would have been obvious to one of ordinary skill in the art to form the APA's device having  $x$  is in the range between 0.15 and 0.90 from  $y$  such as taught by Sawada in order to increase or maximize carrier concentration in the channel layer.

With regard to claims 3,15, APA and Sawada disclose all the claimed subject matter except for  $x$  is substantially 0.53 and  $y$  is substantially 0.43. However, it would have been obvious to one of ordinary skill in the art to form  $x$  is substantially 0.53 and  $y$  is substantially 0.43 in order to increase or maximize carrier concentration in the channel layer.

### **Conclusion**

6. Any inquiry concerning this communication or earlier communication from the examiner should be directed to Tan Tran whose telephone number is (703) 305-3362. The examiner can normally be reached on M-F 8:30AM-5PM.

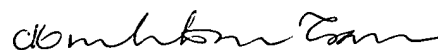
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan Flynn can be reached on (703) 308-6601. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9318 for regular communications and (703) 872-9319 for after final communications.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

TT

Feb 2004



**Minhloan Tran**  
**Primary Examiner**  
**Art Unit 2826**